1883

Hydraulic mining

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THESIS

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HYDRAULIC MINING

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Thesis on Mine - Engineering

Hydraulic-Mining.

Hydraulic-mining
has undoubtedly its origin in
America and principally in the
west, when gold was found in 1848
it was imbedded in strata of clay,
land and gravel, the question arose
how should we get it out of the
clay and etc.? and here is the origin
of hydraulic-mining. First there was
used the simple “pan”, then
something better was found, the
“cradle,” and then it came to the
“tom”, “sluice” and lastly to “hydraulic
mining”, all of these come under
the head of hydraulic-mining,
but the last which bears that
name is resorted to only in
situations where the pay-dirt is
of great thickness, and where
water is abundant; it may be
regarded as the highest branch of
placer mining, since by it a
larger amount of dirt is washed
in a given time and a less expense
than by any other process. Hydraulic
claims are usually situated in
hilly districts, as it is not only
necessary to be provided with
with a column of water of

considerable height, but also to find
in the valleys below the sluices, a
receptacle for the enormous amount
of "debris" resulting from the operation.

I will now give in detail the
aparatus used, and manner of
working them, commencing with
the "pan" down through "hydraulic
mining."

Pan.

The pan is the simplest of all contrivances
for washing auriferous materials,
it is used in all branches of
gold mining, either washing or as
a receptacle for gold amalgam
or for rich dirt. The pan is
made either of stiff tin-plate
or of sheet-iron (the latter is preferred)
with a flat bottom about 12 in.
in diameter, and has sides
from ~~from~~ 5 to 6 inches in height,
sloping towards at an angle of
about 45^0. The process of washing
is conducted in the following way:--
After having been about three-
fourths filled with dirt the pan
is placed in water, which should
not be more than a foot in depth
so that it may rest on the bottom,
while the miner inserts his fingers
in and under the mass, in
order to lift and stir it, in such
a way that it may become

thoroughly wetted throughout. The pan is then held by the two sides, that portion of it which is towards the body being raised, and the opposite edge lowered. He now commences shaking, the clay and sand are washed away, and into the pan there is constantly flowing fresh water, this is washed so long untill the gold and pebbles of stones, (which are thrown away) and a black residue remain, which is black-magnetic iron-sand. To get rid of this black residue it is dried and blown away. The pan is also constantly employed for separating amalgam from sand or pyrites, and for cleaning up rich dirt collected in the cradle, iron or sluice.

Cradle.

The cradle; or rocker, is, after the pan the cheapest and most simple apparatus employed for gold-washing. It rest on two rockers. The cradle-box is 40 inches in length, 20 in breath and is at one end from 18 to 24 in depth, whilst at the other end it slopes off to about 4 inches only. On the deeper end of the

cradle stands a hopper, or riddle box, 20 inches square, with sides from 4 to 6 inches high. The bottom of the riddle is of sheet-iron, perforated with holes half an inch in diameter. Under the riddle is placed an apron of wood or cloth, attached to the sides of the cradle and sloping towards the upper end of the arrangement. Across the bottom of the cradle-box are nailed two riffle bars each about an inch square, one near the riddle and the other at the shallow end.

The dirt to be washed is shovelled into the hopper, and the cradler sits beside his machine; with one hand he pours water upon the dirt, and with the other he imparts to it a rocking motion. By means of the water, aided by the rocking, the dirt is disintegrated and carried through the riddle, falling on the apron, by which it is carried to the head of the box, whence as the bottom has an inclination towards the shallow end, it runs downwards and escapes, leaving the gold, black sand, and heavier particales of gravel behind the riffle-bars.

If the pay-dirt contains many large stones, they are carefully examined

to see whether any particals of gold adhere, if not not they are thrown away. The hopper is about one-third filled with pay-dirt and water is poured in and rocked. Sluicing is sometimes, but not generally, used in the cradle.

Tom.

The "tom" or "long-tom" was formerly used by Californian miners, but it is now seldom employed by them, having become generally superseded the sluice. It consists of a wooden trough about 12 feet in length and 18 inches in width at its upper end, and gradually widening to 30 inches at the lower. Its sides are 8 to 9 inches in heigth and at the lower end, its bottom is of sheet-iron perforated with holes half an inch in diameter. This sheet-iron is turned up, so that the water cannot flow over it, but passes down through the perforated riddle into a riffle-box furnished with transverse bars. The tom itself is arranged at a considerable angle, and a stream of water is admitted at the higher end. The pay-dirt is thrown in at the head and kept constantly well stirred with a shovel, care

being taken to throw back to the upper part of the trough such pieces of clay as are not sufficiently disintegrated. The tom can be most advantageously employed where the amount of stuff to be washed is not large and the gold is coarse. The riffle box is charged with mercury, and as its contents are constantly kept in motion by the falling into it of the water from the riddle above, a considerable proportion of the gold is caught although there is always a notable loss of the finer particles.

Puddling – Box

The puddling-box ordinarily consist of a rough wooden box about 18 inches in in depth and 6 or 8 ft. square, and is employed for the disintegration of very tough clay. Into this box the pay-dirt is thrown, a certain amount of water being introduced at the same time and the miner stirs up the mixture with a hoe, untill all the finer earthy particales are in a state of complete suspension. He then removes the plug from an auger-hole about 4 inches from the bottom and allows the thin mud

to run off, whilst the heavier materials including gold, remain at the bottom. This plug is afterwards again introduced into the hole, and the operation is continued until a sufficient amount of auriferous sand and gravel has been accumulated, when it is cleaned up, either by the end of the pan or cradle.

Sluice.

The sluice is now

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the great washing apparatus in California, and washes nearly all the pay-dirt, and produces the greater portion of the placer gold of that country. It is generally a long wooden trough, through which a stream of water constantly flows, and into which the auriferous material is constantly shovelled. Its length is always several hundred feet, and sluices more than a thousand feet are not infrequently employed. The width is often about 18 inches, but is sometimes as much as 6 feet. It is made of rough pine planks 1½ inches thick, in sections or boxes from 12 to 14 ft. in length the bottom planks being sawn 4 inches wider at one end than at the other. By this means

the narrow end of one box is made
to fit into the board end of the next,
and the sluice is composed of a long
succession of boxes fitting each
other by spigot and faucet joints, but
not otherwise fastened. These boxes
stand on trestles, and have a
descent or "grade" varying from
8 to 18 inches in 12 ft. The amount
of inclination varies with the
nature of the stuff to be washed.
The bottom of the sluice is provided
with riffle-bars. Most commonly
the false bottom is composed of
longitudinal riffle-bars from
2 to 4 in thickness, from 3 to 4
inches wide, and about 5 to 6
inches in length. Two sets of
bars are fitted into each box, and
are wedged in, from 1 to 2 inches apart,
with a transverse bar of the same
width and thickness, placed between
each set of riffles. The bottom is
therefore divided into parallelograms
about 5 to 6 inches in length and
from 1 to 2 inches wide, and from
2 to 4 inches in depth. Sometimes
these riffles are placed zig-zag
across the sluice. The height
of the sides of sluice-boxes varies
from 9 inches to 2 ft. and the
stream of water, has never a less
depth than 2 inches over the bottom.

I might have mentioned that sodium-amalgam is extensively used for collecting the gold, even now.

In nearly all sluices mercury is put in above the riffle-bars, at varies places along the boxes. Sometimes amalgamated copper plates are put in the sluices. Large sluices are not infrequently paved with stones.

Hydraulic-Mining.

Hydraulic-mining is resorted to only in situations where the pay-dirt is of great thickness, and where water is abundant; it may be regarded as the highest branch of placer mining, since by it a larger amount of dirt is washed in a given time, and at a less expense, than by any other process. Hydraulic claims are usually situated in hilly districts, as it is not only necessary to be provided with a column of water of considerable height, but also to find in the valley below the the sluices a receptacle for the enormous amount of "débris" resulting from the operation. Whatever may be the depth of the auriferous deposits, the whole of it should be removed, to the bed-rock. This is as far as possible, effected by the action of water issuing at a

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high pressure from metallic nozzles, and directed against the more or less indurated aluminums to be operated on. This disintegration of the auriferous material goes on simultaneously with the washing of the resulting gravel, and is effected by the same supply of water. In California the water is supplied by stock-companies, who sell the water to these mining companies at so much a miners inch which is equivalent to the amount of water discharged from an aperture 1 inch square, under a mean head of 6 inches, ~~of~~ which flows 10 hours. It cost about 10 or 15 $s per miners inch, and 200 are sometimes used, and 300 of these miners inches are equal to about 284,210 cubic feet, or about 1,772,000 gallons, under ordinary circumstances, from 3000 to 4000 cubic yards of gravel and soft conglomerate may be removed and wash daily by this amount of water.

The installation of a hydraulic washing is commenced by bringing in a stream, by means of a "flume" or aqueduct, to the head of the mining ground, at a height of from 120 to 150 ft. above the level

of the bed-rock, where it is
conducted through a wooden
~~tha~~ trough or tanks, into which
it constantly flows. This is
provided with a suitable
valve, and from it the water
is most commonly conveyed
to the bottom of the claim through
wrought iron pipes from
8 to 12 inches in diameter.
These terminate at their
lower end in a strong
cast-iron box, in which
are apertures provided with
slide-valves and union joints
to which are attached flexible
hose fitted with gun-metal
nozzles 2 to 2 ½ inches in
diameter. The flexible hose
are made of strong-sewn
canvas, which will stand
a pressure of water 50
ft. in height. As however
the pressure is much higher
they must be strengthened
by iron rings or by a net-work
of cordage. These tubes, which
are called "crinoline-hose"

are very strong and flexible,
sustaining a pressure of 180
ft. in height. The amount
of manual labour is very
small, obverse with regard
to the work done, in addition
to the men employed for
directing the various nozzles,
one more is employed to
tend to the sluice.

The cost of treating a cubic
yard of gravel by the various
processes which I have
described, will be approximately
given below.

By the pan	=	20.00
" " cradle	=	5.00
" " long tom	=	1.00
" " puddling box	=	.50
" " sluice	=	.33
" " hydraulic-process	=	.05

The above is dependent on the
miners wages which is about
4.00 per day.

In order to avoid the danger
that would result to workmen
from land-slips on an extensive
scale, the pay-dirt, when above

100 ft in thickness, is often
worked in two or more terraces
or steps, the upper one being
first operated on. Sometimes
they have to resort to blasting
which is not very unusual.
In the majority of cases a
larger amount of water is
required for piping down
the tanks than for washing
the dirt removed, and consequently
when the sand and gravel
are strongly semented together,
the sluice cannot always be
kept properly supplied without
the air of gun-powder.

I now bring it to a close.
Hoping that it will meet
with favor

I remain,

Very resp.,

A. Neustaedter.

Rolla, Mo., June 11, 1883.